

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

1. (Original) A method of applying liquid to a substrate, comprising:

pumping liquid through a dispensing path in a manifold to a dispensing module;

intermittently cycling a dispensing valve of the dispensing module between an open condition for applying liquid from the dispensing module to the substrate and a closed condition for returning liquid from the dispensing module to a recirculation path in the manifold; and

preventing backflow of liquid from the recirculation path to the dispensing module when the dispensing valve is cycling from the open condition to the closed condition.

2. (Original) The method of claim 1, wherein the liquid is a hot melt adhesive.

3. (Original) The method of claim 1, further comprising:

maintaining a pressure of liquid in the recirculation path greater than a pressure of liquid in the dispensing path as the dispensing valve is cycled from the open condition to the closed condition.

4. (Original) The method of claim 1, further comprising:

maintaining a pressure of liquid in the recirculation path greater than a pressure of liquid in the dispensing path when the dispensing valve is in the open condition.

5. (Original) The method of claim 1, further comprising:

maintaining a pressure of liquid in the recirculation path less than a pressure of liquid in the dispensing path when the dispensing valve is in the closed condition.

6. (Original) The method of claim 1, wherein preventing backflow of liquid further comprises positioning a check valve in the recirculation path.

7. (Original) The method of claim 6, further comprising:

sensing whether the check valve is open or closed.

8. (Original) The method of claim 6, further comprising:

maintaining a pressure of liquid in the recirculation path greater than a pressure of liquid in the dispensing path as the dispensing valve is cycled from the open condition to the closed condition.

9. (Original) The method of claim 1, wherein liquid is pumped from a supply channel to the dispensing path and the recirculation path returns liquid to the supply channel.

10. (Original) The method of claim 1, wherein liquid is pumped from a supply channel to the dispensing path and the recirculation path returns liquid to a recirculation channel isolated from the supply channel.

11. (Currently Amended) A method of applying liquid to a substrate, comprising:

coupling a plurality of manifold segments in a side-by-side relationship in which the manifold segments share a supply channel carrying the liquid;

pumping the liquid from the supply channel through a dispensing path coupling each of the manifold segments with a corresponding one of a plurality of dispensing modules;

intermittently cycling a dispensing valve in at least one of the dispensing modules between an open condition for applying the liquid from the dispensing module to the substrate and a closed condition for returning the liquid from the dispensing module to the supply channel through a recirculation path in a corresponding one of the plurality of manifold segments; and

preventing backflow of the liquid from the recirculation path to the dispensing module when the dispensing valve is cycling from the open condition to the closed condition.

12. (Original) The method of claim 11, further comprising:

maintaining a pressure of liquid in the recirculation path greater than a pressure of liquid in the dispensing path as the dispensing valve is cycled from the open condition to the closed condition.

13. (Original) The method of claim 11, wherein preventing backflow of liquid further comprises positioning a check valve in the recirculation path.

14. (Original) The method of claim 13, further comprising:

sensing whether the check valve is open or closed.

15. (Currently Amended) The method of claim 13, further comprising:

maintaining a pressure of liquid in the recirculation path greater than a pressure of liquid in the dispensing path as the dispensing valve is cycled from the open condition to the closed condition.

16. (Original) The method of claim 10, wherein the liquid is a hot melt adhesive.

17. (Currently Amended) An apparatus for applying liquid to a substrate, comprising:

a plurality of ~~modular manifolds~~ manifold segments arranged side-by-side for sharing a supply channel ~~carrying~~ adapted to carry the liquid, each of said ~~modular manifolds~~ manifold segments including a recirculation passageway coupled in fluid communication with said supply channel, a distribution passageway, and a pump

operative for pumping the liquid from said supply channel to said distribution passageway;

a plurality of dispensing modules each including an inlet and a recirculation outlet coupled in fluid communication with said distribution passageway and said recirculation passageway, respectively, of one of said ~~modular manifolds~~ manifold segments; and

a plurality of check valves, one of each of said check valves positioned in said recirculation outlet of a corresponding one of said plurality of dispensing modules.

18. (Currently Amended) An apparatus for applying liquid to a substrate, comprising:

a plurality of ~~modular manifolds~~ manifold segments arranged side-by-side for sharing a supply channel ~~carrying~~ adapted to carry the liquid, each of said ~~modular manifolds~~ manifold segments including a recirculation passageway coupled in fluid communication with said supply channel, a distribution passageway, and a pump operative for pumping the liquid from said supply channel to said distribution passageway;

a plurality of dispensing modules each including an inlet and a recirculation outlet coupled in fluid communication with said distribution passageway and said recirculation passageway, respectively, of one of said ~~modular manifolds~~ manifold segments; and

a plurality of check valves, one of each of said check valves positioned in said recirculation passageway of a corresponding one of said plurality of manifold

segments and arranged to prevent backflow of the liquid from said recirculation passageway to a corresponding one of said plurality of dispensing modules.

19. (Currently Amended) An apparatus for applying liquid to a substrate, comprising:

a manifold including a supply channel for carrying the liquid, a recirculation passageway, a distribution passageway, and a pump operative for pumping the liquid from said supply channel to said distribution passageway;

a dispensing module including an inlet coupled in fluid communication with said distribution passageway and a recirculation outlet coupled in fluid communication with said recirculation passageway; and

a check valve positioned in at least one of said recirculation outlet and said recirculation passageway, said check valve arranged to prevent backflow of the liquid from said recirculation passageway to said dispensing module.

20. (Original) The apparatus of claim 19, wherein said recirculation passageway is coupled in fluid communication with said supply channel.

21. (Original) The apparatus of claim 19, further comprising:

a check valve position sensor located relative to said check valve to detect when said check valve has opened and allowed the liquid to enter said recirculation passageway from said distribution passageway.

22. (Currently Amended) An apparatus for applying liquid to a substrate, comprising:

a manifold including a supply channel for carrying the liquid, a plurality of recirculation passageways, a plurality of distribution passageways, and at least one pump operative for pumping the liquid from said supply channel to each of said distribution passageways;

a plurality of dispensing modules each including an inlet coupled in fluid communication with one of said distribution passageways and a recirculation outlet coupled in fluid communication with one of said recirculation passageways; and

a plurality of check valves, one of each of said check valves positioned in a corresponding one of said recirculation passageways of said manifold and arranged to prevent backflow of the liquid from said recirculation passageway to a corresponding one of said plurality of dispensing modules.

23. (Original) The apparatus of claim 22, wherein each of said plurality of recirculation passageways is coupled in fluid communication with said supply channel.

24. (Original) The apparatus of claim 22, further comprising:

a plurality of check valve sensors, each sensor located relative to a corresponding one of said check valves to detect when said corresponding one of said check valves has opened and allowed the liquid to enter said corresponding one of said recirculation passageways and a corresponding one of said distribution passageways.

25. (Currently Amended) An apparatus for applying liquid to a substrate, comprising:

a manifold including a supply channel for carrying the liquid, a plurality of recirculation passageways, a plurality of distribution passageways, and at least one pump operative for pumping the liquid from said supply channel to each of said distribution passageways;

a plurality of dispensing modules each including an inlet coupled in fluid communication with one of said distribution passageways and a recirculation outlet coupled in fluid communication with one of said recirculation passageways; and

a plurality of check valves, one of each of said check valves positioned in said recirculation outlet of a corresponding one of said dispensing modules.

26. (Original) The apparatus of claim 25, wherein each of said plurality of recirculation passageways is coupled in fluid communication with said supply channel.

27. (Original) The apparatus of claim 25, further comprising:

a plurality of check valve sensors, each sensor located relative to a corresponding one of said check valves to detect when said corresponding one of said check valves has opened and allowed the liquid to enter said corresponding one of said recirculation passageways and a corresponding one of said distribution passageways.

28. (Currently Amended) An apparatus for applying liquid to a substrate, comprising:

a plurality of ~~modular manifolds~~ manifold segments arranged side-by-side for sharing a supply channel ~~carrying~~ adapted to carry the liquid, each of said ~~modular~~

~~manifolds~~ manifold segments including a recirculation passageway coupled in fluid communication with said supply channel, a distribution passageway, and a pump operative for pumping the liquid from said supply channel to said distribution passageway;

a plurality of dispensing modules each including an inlet and a recirculation outlet coupled in fluid communication with said distribution passageway and said recirculation passageway, respectively, of one of said ~~modular manifolds~~ manifold segments;

an adapter plate having a plurality of recirculation passageways each coupling said recirculation passageway of one of said plurality of ~~modular manifolds~~ manifold segments with said recirculation outlet of a corresponding one of said dispensing modules; and

a plurality of check valves, one of each of said check valves positioned in a corresponding one of said recirculation passageways of said adapter plate.

29. (Currently Amended) An apparatus for applying liquid to a substrate, comprising:

a manifold including a supply channel for carrying the liquid, a recirculation passageway, a distribution passageway, and a pump operative for pumping the liquid from said supply channel to said distribution passageway;

a dispensing module an inlet coupled in fluid communication with said distribution passageway and a recirculation outlet coupled in fluid communication with said recirculation passageway;

an adapter plate having a recirculation passageway coupling said recirculation passageway with said recirculation outlet; and

a check valve positioned in said recirculation passageway of said adapter plate.

30. (Original) The apparatus of claim 29, wherein each of said plurality of recirculation passageways is coupled in fluid communication with said supply channel.

31. (Currently Amended) An apparatus for applying liquid to a substrate, comprising:

a manifold including a supply channel for carrying the liquid, a plurality of recirculation passageways, a plurality of distribution passageways, and at least one pump operative for pumping the liquid from said supply channel to each of said distribution passageways;

a plurality of dispensing modules each including an inlet coupled in fluid communication with one of said distribution passageways and a recirculation outlet coupled in fluid communication with one of said recirculation passageways; and

an adapter plate having a plurality of recirculation passageways each coupling said recirculation passageway of one of said manifold with said recirculation outlet of a corresponding one of said dispensing modules; and

a plurality of check valves, one of each of said check valves positioned in a corresponding one of said recirculation passageways of said adapter plate.

32. (Original) The apparatus of claim 31, wherein each of said plurality of recirculation passageways is coupled in fluid communication with said supply channel.

33. (Currently Amended) A method of applying liquid to a substrate, comprising:

pumping the liquid through a dispensing path extending through a manifold and a dispensing module;

cycling the dispensing module to an open condition thereby dispensing the liquid from the dispensing module to the substrate;

cycling the dispensing module to a recirculating condition preventing the liquid from dispensing onto the substrate;

returning the liquid from the dispensing module to a recirculation path in the manifold while the dispensing module is in the ~~closed~~ recirculating condition; and

sending a signal to a control coupled with the dispensing module indicating that the dispensing module is in the recirculating condition.

34. (Original) The method of claim 33, wherein the dispensing module further comprises a movable valve element configured to selectively place the dispensing module in the recirculating condition and further comprising:

magnetically sensing a change in the position of the movable valve element, and

sending the signal after magnetically sensing the change in the position of the movable valve element.

35. (Original) The method of claim 33, wherein the dispensing module further comprises a movable valve element configured to selectively place the dispensing module in the recirculating condition and further comprising:

electrically sensing a change in the position of the movable valve element,
and

sending the signal after electrically sensing the change in the position of the movable valve element.

36. (Original) The method of claim 33, wherein the dispensing module further comprises a movable valve element configured to selectively place the dispensing module in the recirculating condition and further comprising:

acoustically sensing a change in the position of the movable valve element, and

sending the signal after acoustically sensing the change in the position of the movable valve element.

37. (New) An apparatus for applying liquid to a substrate, comprising:

a manifold including a supply channel for carrying the liquid, a recirculation passageway, a distribution passageway, and a pump operative for pumping the liquid from said supply channel to said distribution passageway;

a dispensing module including an inlet coupled in fluid communication with said distribution passageway and a recirculation outlet coupled in fluid communication with said recirculation passageway, said recirculation outlet and said recirculation

passageway defining at least a portion of a recirculation path extending to said supply channel; and

a check valve positioned in said recirculation path and configured to prevent backflow of the liquid within said recirculation path.